Speed regulators,
Manually controlled.

No. 818,612.

PATENTED APR. 24, 1906.

H. CROUAN.

REGULATOR FOR GAS AND PETROLEUM MOTORS.

APPLICATION FILED JAN. 3, 1899.

4 SHEETS—SHEET 1.

Fig. 1.

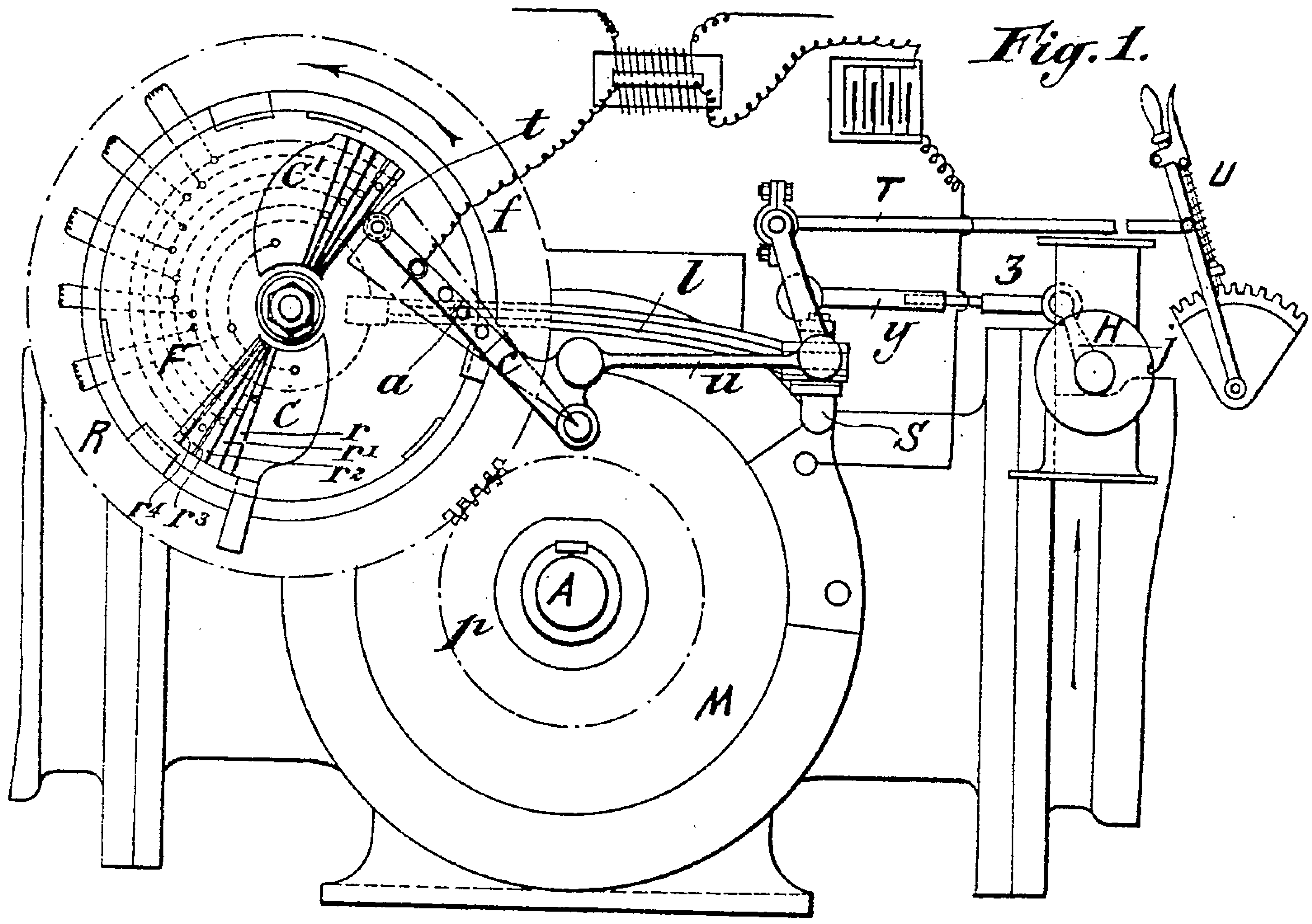
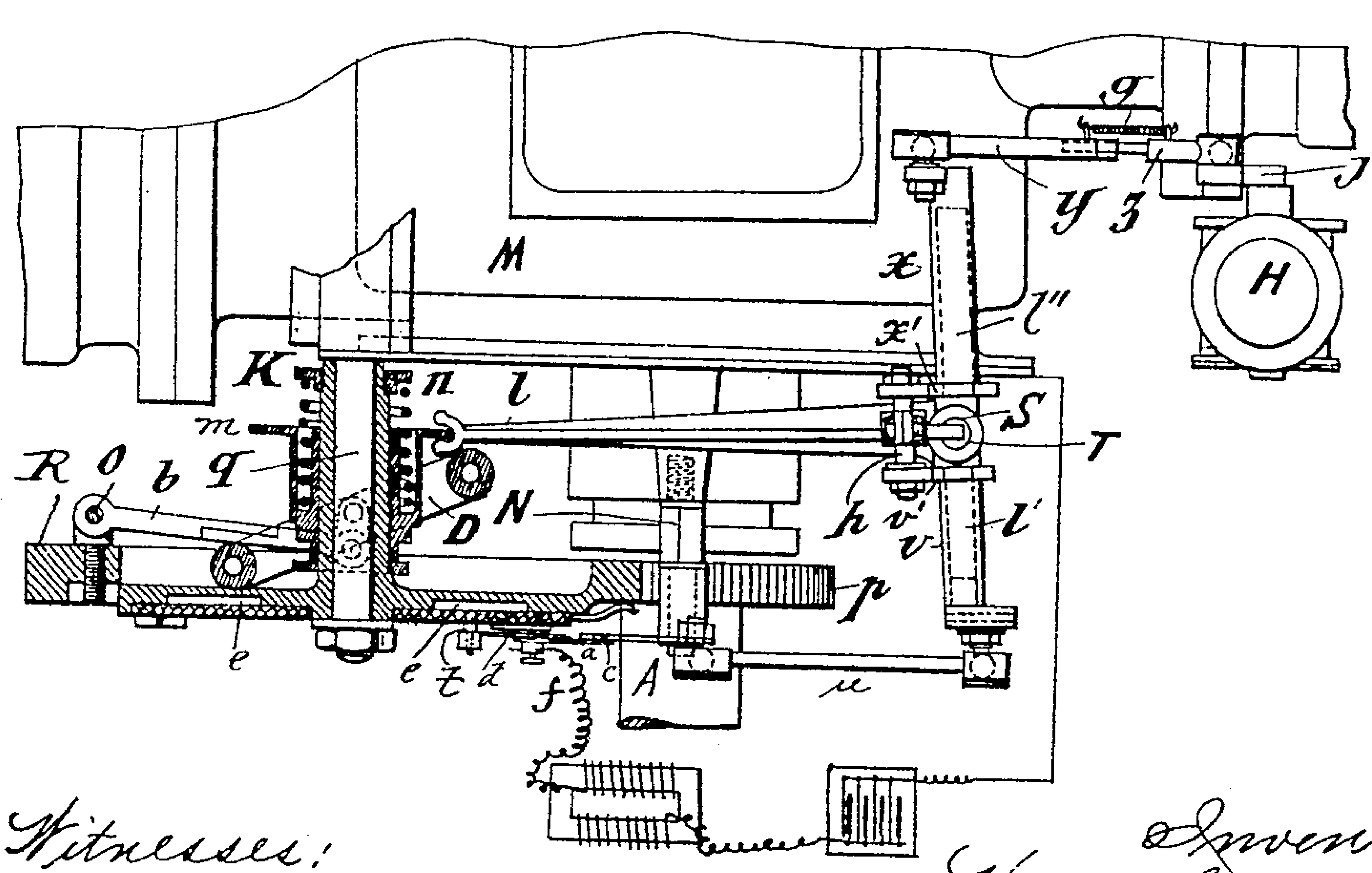


Fig. 2.



Witnesses:
H. K. Boulter
C. G. Thornthrup

Inventor
Henry Crouan,
By Wm. E. Boulter,
Attorney

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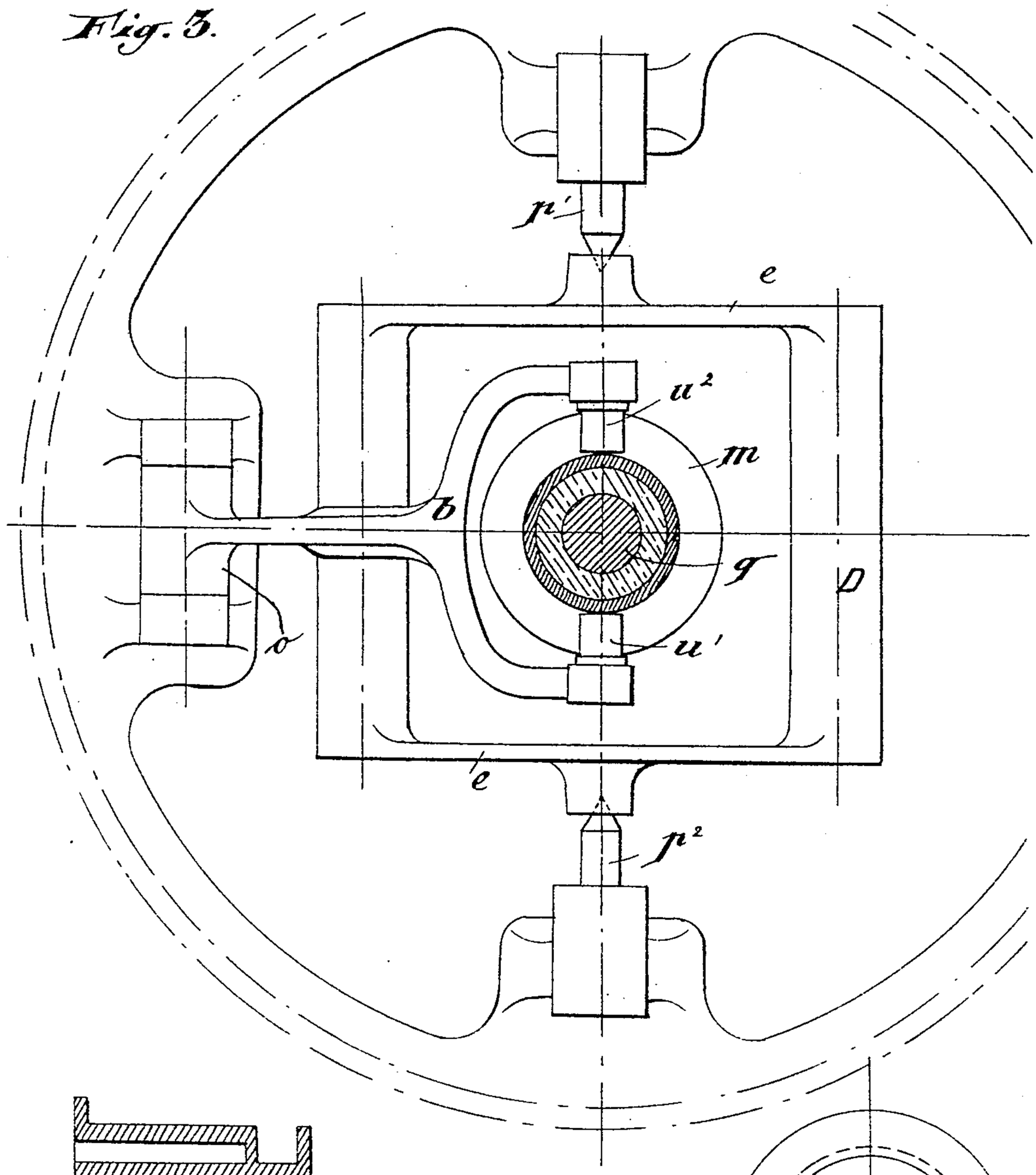
4 SHEETS—SHEET 2.

Fig. 3.



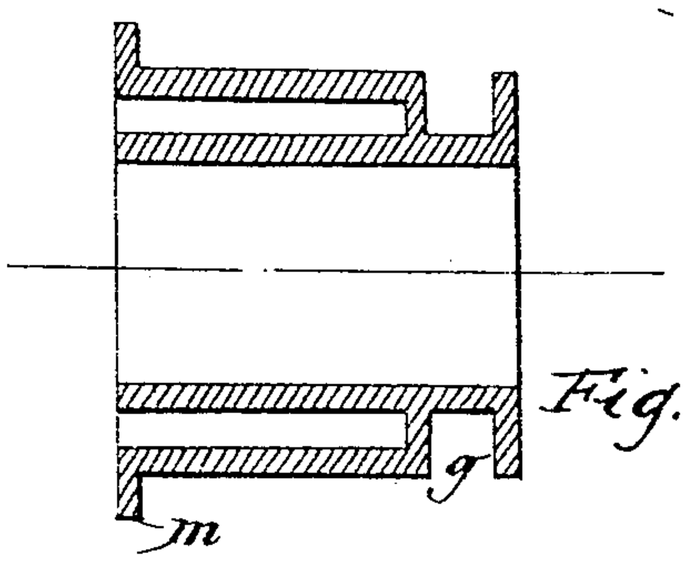


Fig. 4

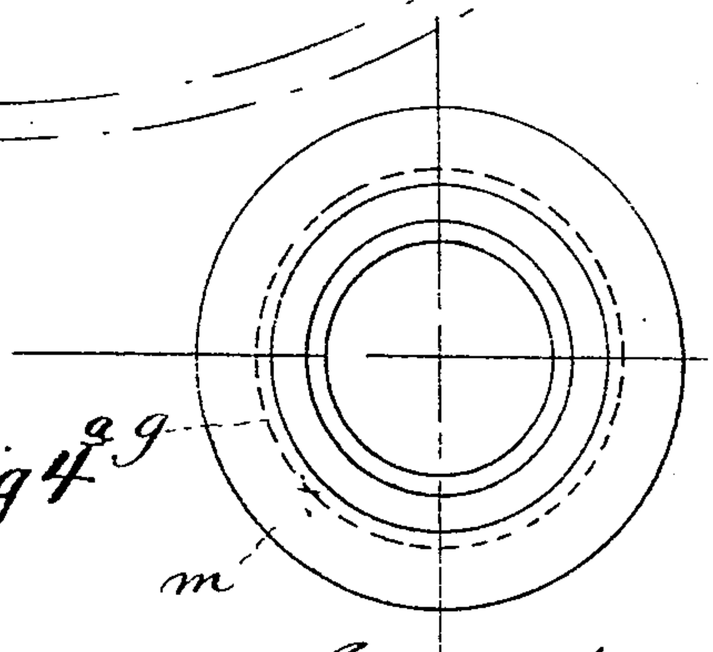


Fig 4a

Witnesses
W. H. Boulter
[illegible]

Inventor
Henry Crouan,
By Wm. C. Boulter.
Attorney

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H. CROUAN.

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4 SHEETS—SHEET 3.

Fig. 5.

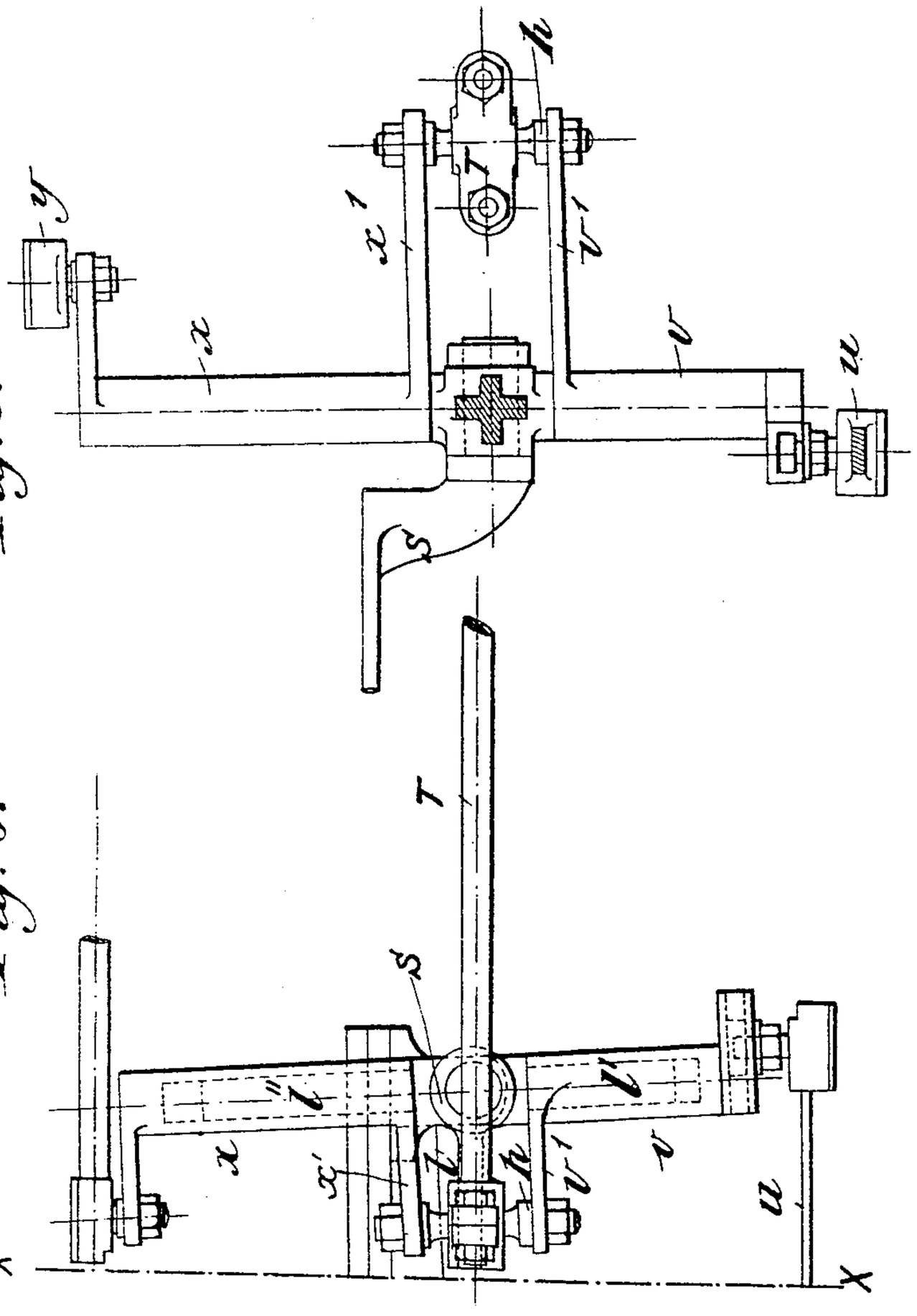

Fig. 6.

Witnesses:
W. K. Breck
C. Thorkuff

Inventor
Henry Crouan,
By Wm. E. Boulden
Attorney.

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H. CROUAN.

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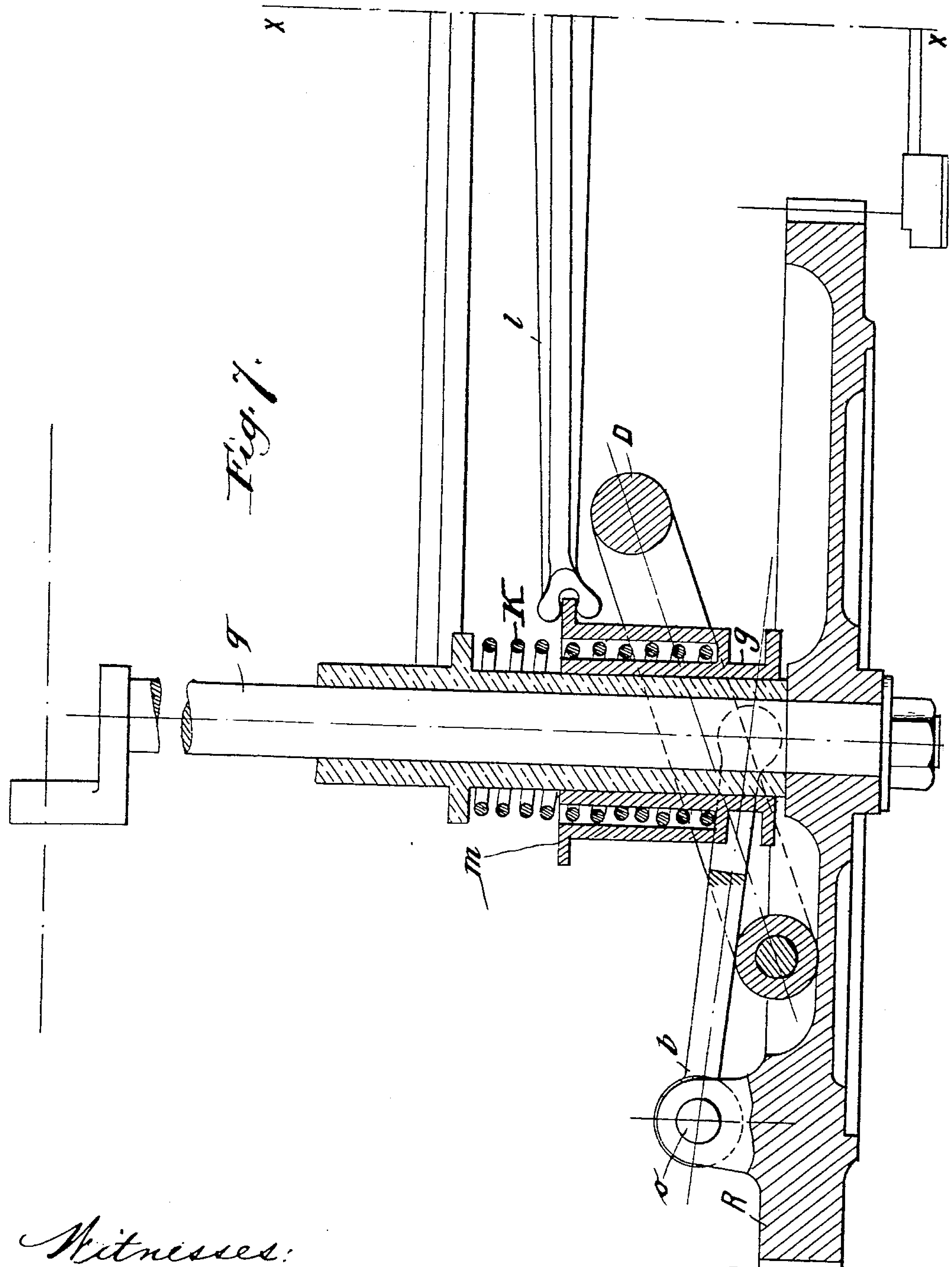
4 SHEETS—SHEET 4.

Fig. 7.



Witnesses:

H. K. Boulter

O. G. Northup

Inventor

Henry Crouan

By Wm. E. Boulter

attorney

UNITED STATES PATENT OFFICE.

HENRY CROUAN, OF CLICHY, FRANCE.

REGULATOR FOR GAS AND PETROLEUM MOTORS.

No. 818,612. Specification of Letters Patent. Patented April 24, 1906.

Application filed January 3, 1899. Serial No. 701,027.

To all whom it may concern:

Be it known that I, HENRY CROUAN, a citizen of the Republic of France, residing at Clichy, Department of the Seine, France, have invented certain new and useful Improvements in Regulators for Gas and Petroleum Engines, of which the following is a specification.

My invention relates to gas or petroleum engines, and has more particular reference to regulators for such engines capable of controlling at any moment the force of explosion in order to produce the required power and to suitably limit the rate of speed of the engine.

In order that my invention may be properly understood, I have hereunto appended four explanatory sheets of drawings, in which like letters of reference denote similar parts.

Figure 1 is a broken side elevation of an engine provided with my improved device, and Fig. 2 is a plan view of same with parts shown in section. Fig. 3 is a sectional plan view of the regulator. Fig. 4 is a vertical sectional view of sleeve *m*. Fig. 4ª is an end view of the sleeve *m*. Fig. 5 is a plan view of the lever *l* and contiguous parts. Fig. 6 is an elevation of the parts seen in Fig. 5 at right angles to said Fig. 5. Fig. 7 is a sectional view showing the regulator, the sleeve *m*, part of lever *l*, and contiguous parts.

My improved regulator is essentially composed of two weights, (indicated by reference-letter D in the accompanying drawings,) said weights being mounted on the ends of two arms adapted to turn around two journals p' p^2. The journals p' p^2 are carried by the wheel R of the engine, and the regulator is adapted to make one revolution for each two revolutions of the engine. By the action of centrifugal force this regulator tends to get upright and to be placed across the shaft *q*, around which revolves the wheel R, mounted thereon, whereby it presses upon a yoke-link *b*, turning around the pivot *o* and carrying with it the sliding sleeve *m*, said sleeve being under the action of the coil-spring K. It follows from this arrangement that to each rate of speed of the engine will correspond a determined position of the sleeve *m*. The latter actuates a three-armed lever *l*, turning around a journal S and following the movement of sleeve *m*. Said three-armed lever *l*, one branch of which is actuated by sleeve *m*, carries two tubes *v* and *x*, fitted over its two other cylindrical branches, said tubes *v* and *x* being provided at their adjacent ends with two crank-arms v' and x', respectively, connected by a brace *h*, to which is pivotally secured an operating-lever T, and it follows from this construction that said operating-lever T will cause said tubes *v* and *x* to revolve together in either direction, according to the motion imparted to the same, or will lock said tubes on the three-armed lever *l* when at rest and locked itself by means of the lever U, which may be locked in different positions by the usual spring-actuated dog-and-rack device. (Seen at the right-hand end of Fig. 1.)

The tube *x* carries a small arm mechanically connected with the arm *j* of throttle-valve H, controlling the admission of the explosive mixture through the intermediary of a slotted rod *y*, the central slot of which receives the branch *z*, telescoped therein and connected with arm *y* by a spring or its equivalent *g*.

The tube *v* carries a small arm operating by means of the rod *u* the electric contact-piece *c*, the part *d* of which is connected therewith by an intermediary *a* of insulating material in such a manner that the current at the terminal will only pass through the engine when the end of the contact-piece contacts with the metallic parts C and C′, mounted on an intermediary F of insulating material and secured to wheel R, electrically connected with the body of the engine. On the side of each metallic part C C′ there is a plurality of small parts r r' r^2 r^3, independent of one another and of the parts C C′, but connected with one another and with the parts C C′ by means of very thin but strong wires. Thus between the part C and the part *r* there is a thin and very short wire, between *r* and r' there is another longer wire, and so on, so that a gradually-increased resistance will be inserted into the circuit, according as the contact takes place on C r r' r^2 r^3 r^4. The metallic parts C C′ are suitably shaped so that the circuit may be closed at the desired moment in accordance with the position of the contact-piece *d*, depending on the speed of the engine. There are two parts C and C′ closing the current, because the wheel R makes but one revolution for two revolutions of the engine and because there must be one ignition at each revolution of the engine either for one cylinder or the other, provided that the engine has two cylinders, with one explosion at each revolution.

The movement of the rod T has practically

no effect on the rod *u*, because the travel of the arm end, to which said rod is connected, is nearly *nil*. The igniter I use is the subject of the British Patent No. 25,582, 1897, and therefore I deem it unnecessary to add further description of it here. The contact-breaker, which serves both to close and to break the circuit at the required moments, is placed in a weak current derived from an ordinary or a storage battery. The sliding contact-piece *t*, secured at the end of the spring-blade and connected by a wire *f* with one of the terminals of the battery, closes the circuit when it comes into contact with the metallic part C or C′ of the contact-breaker, said contact-breaker being in contact with the body of the motor, which is in turn connected with the other terminal of the battery. As an induction-coil is inserted in the circuit of the battery, and as this coil is connected with the igniter above mentioned, immediately the circuit is established an electric spark is produced on the igniter, which is screwed in the bottom of the cylinder, and the mixture is thereupon ignited.

When sliding contact *t* leaves the contact C or C′, the circuit is open, as the whole of part F of the contact-breaker is formed of insulating material, or else it is insulated. The circuit being open, the coil no longer generates an induced current and the igniter produces no spark.

The object of the resistances $r\ r'\ r^2\ r^3\ r^4$ is as follows: When an electric current is suddenly interrupted, a spark is produced which has an injurious and deteriorating effect on the metal. Consequently the contact C and C′ were it not for the resistance I provide would soon become inoperative. Instead of abruptly breaking the current it is gradually weakened by the insertion of five or six resistances, each stronger than the one immediately preceding it, the current, say, of three amperes, being thus reduced first to two and one-half, then to two, then one and one-half, and so on until it is entirely broken. There will still be the extra break-current, but it will be of such small intensity that no spark will be produced and there will consequently be no wearing away of the metal or deterioration of the metallic contacts. With this object in view the resistance-plates $r\ r'\ r^2\ r^3\ r^4$ are connected, the first plate with the principal contact C or C′, the second with the first, and so on, each plate being connected with the preceding one by means of a German-silver or white-metal wire of such length and strength that the current will each time be diminished proportionately to the number of plates, thereby avoiding the spark and preserving the contacts from injury.

My improved engine will operate as follows: First, I will consider three principal rates of speed, it being well understood that the intermediary rates of speed may be obtained by a corresponding movement of the rod T.

1. *Low speed.*—I pull the operating-lever T in the direction of the arrow, Fig. 1, whereby the rod *y* will be thrown into contact with the part *z* without moving the three-armed lever *l*. With the least movement of the regulator the inlet-valve tends to be shut, and the engine will therefore revolve at a very low rate of speed. If I desire a still lower rate of speed, I have but to pull said operating-lever T still farther and the inlet-valve will almost be shut before the beginning of the action of the regulator. As soon as the latter operates said inlet-valve will be completely shut and the speed of the engine will be as low as possible.

2. *Normal speed.*—In order to obtain a normal rate of speed, I push the operating-lever T back in such a manner that there will be a suitable distance between the parts *y* and *z*. The regulator, therefore, must first move back said operating-lever (to compensate said distance between *y* and *z*) before acting upon the inlet-valve, and consequently the engine will revolve at a higher rate of speed before causing the inlet-valve to be shut.

3. *High speed.*—If it is desired to obtain the maximum of speed, the operating-lever T has but to be pushed back sufficiently so that the regulator in either position cannot cause the rod *y* to contact with *z*. Said regulator will therefore no longer act upon the inlet-valve and the speed of the engine will not be limited. The contact-piece *t* causes the moment of ignition to be modified in accordance with the opening of the inlet-valve—that is, in accordance with the quality of fresh explosive mixture to be introduced. This variable quantity of fresh mixture will form with the constant quantity of consumed mixture remaining within the cylinder after each stroke of the piston an explosive mixture of variable combustibility. The moment of ignition must therefore vary with the degree of said mixture and said ignition must take place so much the faster, as the explosive mixture is weaker. This will be effected by the relative movement of the tube *v*, whereby the explosive mixture will be ignited in accordance with the degree of combustibility thereof with regard to the moment of ignition.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a regulator for gas or petroleum engines, the combination with a throttle-valve and an operating-wheel therefor, of a weighted lever, a sleeve connected therewith and fitted over the shaft of the said wheel, a controlling-spring, a yoke-link journaled at one end and connected at the other end with the sleeve, a three-armed lever mechanically con-

nected with the throttle-valve, a tubular sleeve *x* fitted over one branch of said lever, a rod pivotally attached to said tubular sleeve and provided with a central slot a second rod adapted to extend into the former and connected with the stem of the throttle-valve, a suitable spring connecting said rods and means for allowing the position of said tubular sleeve *x* to be determined by hand, at will, substantially as described.

2. In a speed-regulating device for gas or petroleum engines, the combination with a throttle-valve and an operating-wheel, of the weighted lever, the sliding sleeve actuated thereby and mounted on the shaft of said wheel, the controlling-spring, the yoke-link journaled at one end and connected at the other end with the sleeve, a two-armed lever *l* adapted to turn round the journal and carrying a tubular sleeve *x* provided with a crank-arm, a rod *y* pivoted thereon and a second rod *z* suitably connected with the former and with the throttle-valve.

3. In a speed-regulator for gas or petroleum engines, the combination with a throttle-valve, of an operating-wheel, a lever mechanically connected with said wheel and carrying a tubular sleeve fitted over one of its branches, a connecting-rod pivotally attached thereto, an ignition device having a contact-piece actuated by the said connecting-rod and a series of contacts adapted to offer a gradual increased resistance to the electric current, substantially as described.

HENRY CROUAN.

Witnesses:
CAMILLE ROLLAND,
AD HURON.